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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER				
OCHYLSKI, RYAN M				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/537,497

Applicant(s)

NAKANISHI ET AL.

Examiner

RYAN OCHYLSKI

Art Unit

1791

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SF/ICE)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. This is a FINAL Office Action in response to Applicant's reply of April 8, 2009, which was a response to a non-final Office Action mailed on January 16, 2009. Claims 1-4 and 7 have been amended, Claims 8-12 have been added, and no Claims have been canceled.

Claim Objections

2. Claims 8-12 are objected to because of the following informalities: The Examiner presumes that the temperature ranges recited in Claims 8-12 are intended to represent the final temperature of the poor solvent of Claim 1. However, as written, Claims 8-12 might reasonably be interpreted as reciting a temperature at which the poor solvent begins before being adjusted to the claimed range. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1-2, 5-6, and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. ("Aromatic Polyimide Nano-spheres Prepared by Reprecipitation Method") in view of Lee et al. ("Solution properties of poly(amic acid)-NMP containing LiCl and their effects on membrane morphologies") as evidenced by Asao et al. (US 6,187,899).

7. Regarding Claims 1 and 8-9, Suzuki et al. teach a method for preparation of porous polyimide microparticles comprising

- forming polyamide acid microparticles by pouring a polymer solution prepared by dissolving polyamide acid into a poor solvent ("poured into mix solution of cyclohexane / carbondisulfide" Paragraph 2) to form a polyamide acid concentration
 - and the temperature of which is adjusted to the range of -20°C to 60°C ("temperature of poor solution at around 20°C" Paragraph 3);

- wherein particle size of said polyamide acid microparticles is adjusted to 50 nm to 10,000 nm by controlling the temperature of said poor solvent ("PAA nano-spheres of 100nm particle size ... particle size of PAA nano-spheres changed remarkably by temperature of poor solution" Paragraph 3),
- then treating said polyamide acid microparticles by thermal imidation ("by heat imidizing it" Paragraph 1).

However, Suzuki et al. does not teach the polyamide acid (PAA) contains 0.5 to 80 weight % of alkali metal salt, that the concentration of the PAA in the poor solvent is 0.1 to 15 weight%, that the pore size of the PAA microparticles is adjusted to the range from 20 nm to 500 nm and porosity of the PAA microparticles is adjusted to the range from 0.1% to 30% by controlling a content or kind of alkali metal salt, or that the PAA microparticles undergo imidation so that the particle size distribution, pore size, and porosity of the PAA microparticles are maintained.

In analogous art pertaining to polyamide acid solution preparation, Lee et al. teach that polyamide acid contains 0.5 to 80 weight % of alkali metal salt ("LiCl ... 0 to 8 wt.%" Page 268 Column 2 Paragraph 2) and that the PAA is diluted to a concentration of 0.1 to 15 weight% ("0.1 ... 2 wt.%" Page 268 Column 2 Paragraph 2) for the benefit of providing appropriate conditions for an alkali metal salt to adjust the morphology of PAA.

Lee et al. further teach that pore size and porosity of the PAA are adjusted by controlling a content of alkali metal salt ("When the LiCl content in the solution was raised to 5 wt.%" Page 275 Column 1 Paragraph 1) for the benefit of making the PAA

structure more porous with fine pores and, hence, mechanically stronger (as per Page 275 Lines 18-22). While Lee et al. does not disclose any explicit values for pore size or porosity of the PAA, Figure 7 clearly suggests pore sizes on the order of 20 nm to 500 nm and porosity on the order of 0.1% to 30%. Thus the hypothetical combination discloses the claimed invention except for explicit recitation of pore sizes on the order of 20 nm to 500 nm and porosity on the order of 0.1% to 30%. It would have been obvious to one having ordinary skill in the art at the time of the invention to make the pore sizes in the range from 20 nm to 500 nm and porosity in the range from 0.1% to 30%, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to make the pore sizes in the range from 20 nm to 500 nm and porosity in the range from 0.1% to 30% for the benefit of making the PAA structure more porous with fine pores and, hence, mechanically stronger.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to combine Suzuki et al. with Lee et al. for the benefit of providing appropriate conditions for an alkali metal salt to adjust the morphology of PAA and then making the PAA structure more porous with fine pores and, hence, mechanically stronger.

Note that while the hypothetical combination does not explicitly teach that the microparticles undergo imidation so that the particle size distribution, pore size, and porosity of the PAA microparticles are maintained, this result is an expected result as evidenced by Asao et al. ("particle morphology of the polyimide microfine particles

usually traces back to the morphology of the polyamic acid microfine particles" Column 5 Line 67- Column Line 3) and is not given patentable weight.

8. Regarding Claim 2, Suzuki et al. teach that an organic solvent is used as a good solvent in which the polyamide acid is dissolved ("NMP solution of PAA" Paragraph 2) and that the poor solvent is a mixture of cyclohexane and carbondisulfide (as applied to Claim 1 above).

9. Regarding Claims 5 and 6, Suzuki et al. the weight average molecular weight of the polyamide acid is in the range from 8000 to 220,000 ("Mw=48,000-122,000" Paragraph 3).

10. Claims 3-4, 7, and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. ("Aromatic Polyimide Nano-spheres Prepared by Reprecipitation Method") in view of Lee et al. ("Solution properties of poly(amic acid)-NMP containing LiCl and their effects on membrane morphologies") as applied to Claims 1, 2, and 5, respectively, and in further view of Asao et al. (US 6,187,899).

11. Regarding Claims 3, 4 and 7, the previous combination remains as applied above and teaches the general method as applied above, including that the polyamide acid microparticles have pore size porosity controlled by contents of alkali metal salt (as applied to Claim 1 above).

However, the previous combination does not teach that chemical imidation is completed by adding acetic acid anhydride–pyridine mixed solvent to polyamide acid microparticles by stirring.

In analogous art pertaining to polyimide microparticle production, Asao et al. teach that chemical imidation is completed by adding acetic acid anhydride–pyridine mixed solvent to polyamide acid microparticles by stirring (Column 5 Lines 47-54) for the benefit of allowing the imidation to occur at less than 130°C, which allows for greater options regarding the solvent to be used, allowing for greater economic efficiency as raw material prices fluctuate.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to combine the previous combination with Asao et al. for the benefit of allowing the imidation to occur at less than 130°C, which allows for greater options regarding the solvent to be used, allowing for greater economic efficiency as raw material prices fluctuate.

12. Regarding Claims 10-12, Suzuki et al. teach “particle size of PAA nano-spheres changed remarkably by temperatures of poor solution at around 20°C” in the [Results and Discussion] section, but the previous combination does not expressly teach that the temperature is adjusted to 30°C, 40°C, or 60°C. Furthermore, while the previous combination does not expressly teach the shape of the relationship between temperature and particle size, a skilled artisan would have been motivated to determine the nature of that relationship, given the critical nature of the relationship indicated by

the use of the word "remarkably" to describe the correlation, and would thus have found the inherent result-effective relationship in which increasing temperatures would reduce particle size.

However, the previous combination does not expressly provide motivation for adjusting the particle size to sizes other than the disclosed 100 nm particle size.

In analogous art pertaining to polyimide microparticle production, Asao et al. teach the general desire to produce smaller particles to improve monodispersibility (Abstract in view of Column 1 Lines 37-48).

Thus, given motivation to make smaller particles and a result-effective variable relationship that allows smaller particles to be made by increasing poor solvent temperatures, it would have been obvious to one having ordinary skill in the art at the time of the invention to combine Asao et al. with the previous combination and adjust the temperature to 30°C, 40°C, or 60°C, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to adjust the temperature to 30°C, 40°C, or 60°C for the benefit of creating smaller particle sizes that allow for better monodispersity.

Response to Arguments

13. Applicant's arguments filed April 8, 2009 have been fully considered but they are not persuasive.

14. Specifically regarding Claim 1, Applicant argues that:

"*Lee et al.* fails to teach the presently claimed pore sized on the order of 20 to 500 nm, and porosity on the order 0.1 % to 30%. All Fig. 7 shows is a cross-section of a membrane with a legend of 100 μm , which is on a scale to measure the macrovoids of (a) and (b) To extrapolate from this that Fig. 7 teaches pore size on the order of 20 to 500 nm or porosity on the order of 0.1 % to 30% is purely speculative." (Page 7 Lines 9-19 of Applicant's remarks)

The Examiner agrees that *Lee et al.* does not explicitly teach such conditions. However, whether *Lee et al.* explicitly teaches conditions is not the matter at hand. In the rejection as applied in the instant Office Action, as well as the January 16, 2009 Office Action, the Examiner states the combination of *Lee et al.*'s teaching (that one can increase LiCl content to simultaneously decrease pore size and increase porosity for an overall benefit of increasing mechanical strength) with Figure 7 is sufficient motivation such that a person having ordinary skill in the art at the time of the invention could arrive at microparticles having properties as claimed. Applicant is silent with regard to this aspect of the rejection (applied above and in the January 16, 2009 Office Action).

Furthermore, the Examiner's statement that Figure 7 demonstrates conditions on the order of 20-500 nm pore size and 0.1 to 30% porosity is merely meant to establish that the general conditions of the claimed invention are present. Specifically, given the 100 μm scale of Figure 7(c) and the lack of pores that are clearly of sizes greater than 1 μm , *Lee et al.* is clearly concerned with pore sizes on the order of 500 nm. Additionally,

given that the structure of 7(c) does not clearly comprise a greater than 50% porosity (i.e. it is not clear that more than half the structure is darker than the rest), Lee et al. is clearly concerned with porosities on the order of 30%. Finally, the Examiner does invoke any sort of inherency argument in the previous or current Claim 1 rejection.

15. Further regarding Claim 1, Applicant's argument that "*Lee et al.* [is] unsuitable for the intended purpose of making the claimed limitation of **0.5 to 80 weight %** of alkali metal salt because a 3 weight % of LiCl [that produces a macroporous membrane] falls within the claimed range" on Page 7 Lines 2-9 of Applicant's remarks does not overcome the fact that Lee et al. teach a 5 weight % LiCl content that produces a microporous structure, thus providing the motivation to optimize via result-effective variables to achieve claimed conditions as applied above.

16. Lastly, the Examiner notes that Applicant's argument that the poor solution temperature of 20°C taught by Suzuki et al. cannot render obvious the entire claimed range of -20°C to 60°C is not sufficient to overcome the previous and current rejections of Claim 1, or the current rejections of newly-added Claims 8-9, since 20°C falls within the claimed ranges of each of the respective claims.

Specifically regarding Claims 10-12, Applicant essentially argues on Page 6 Line 5 - Page 7 Line 3 of Applicant's remarks that neither Suzuki et al. nor Asao et al. teach the criticality of the relationship between temperature and particle size. The Examiner disagrees. Suzuki et al. recite "particle size of PAA nano-spheres changed

remarkably by temperatures of poor solution at around 20°C" in the [Results and Discussion] section. Applicant considers this disclosure to represent a "single data point." However, it is the Examiner's position that this disclosure fully indicates the criticality of the relationship between temperature and particle size, and would provide clear motivation to a person having ordinary skill in the art at the time of the invention to determine the shape of the critical behavior so that the person could optimize PAA particle size by adjusting the temperature.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RYAN OCHYLSKI whose telephone number is 571-270-7009. The examiner can normally be reached on Monday through Thursday and every other Friday from 9:00-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 571-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

rmo

/Joseph S. Del Sole/
Supervisory Patent Examiner, Art Unit 1791